Claims

[c1] 1. A device for detecting a chemical or biological agent and treating a person exposed to the agent, the device comprising:
a unit sufficiently small and light-weight to be carried by a person, the unit comprising at least one antidote, means coupled to the at least one antidote for selecting the at least one antidote, means for delivering the at least one antidote into the body of the person, and means for communication between the selecting means and the delivering means; and
means for detecting and identifying a chemical or biological agent near the person, the detecting and identifying means being in communication with the selecting means and operable to identify the at least one antidote as being capable of counteracting the agent and then causing the delivering means to deliver the at least one antidote into the body of the person.

[c2] 2. The device according to claim 1, wherein the delivering means comprises:
a tube comprising a freestanding tube portion through which the fluid flows;

means for vibrating the freestanding tube portion of the tube at a resonant frequency thereof that varies with the density of the at least one antidote flowing therethrough, the Coriolis effect causing the freestanding tube portion to twist while being vibrated at resonance, the free-standing tube portion exhibiting a degree of twist that varies with the mass flow rate of the at least one antidote flowing therethrough;

means for sensing movement of the freestanding tube portion of the tube, the movement-sensing means producing a first output signal based on the resonant frequency of the freestanding tube portion and a second output signal based on the degree of twist of the free-standing tube portion;

means for measuring elapsed time during which the at least one antidote has flowed through the tube; and

means for stopping flow of the at least one antidote through the tube in response to either of the first and second output signals from the movement-sensing means.

[c3] 3. The device according to claim 1, wherein the delivering means is operable to deliver the at least one antidote subdermally, intravenously, subcutaneously, or intramuscularly.

[c4] 4. The device according to claim 1, wherein the unit comprises a plurality of antidotes and the selecting means selects among the plurality of antidotes.

[c5] 5. The device according to claim 1, wherein the selecting means is operable to select more than one antidote, and the delivering means is operable to deliver the more than one antidote into the body of the person.

[c6] 6. The device according to claim 1, wherein the detecting and identifying means is remote from the unit and not carried by the person.

[c7] 7. The device according to claim 1, wherein the detecting and identifying means is physically coupled to the unit and carried on the person.

[c8] 8. The device according to claim 1, wherein the detecting and identifying means comprises:
a freestanding tube portion through which flows a portion of atmosphere surrounding the person, the freestanding tube portion comprising an internal passage containing a substance selective to the agent so that matter accumulates within the freestanding tube portion;
means for vibrating the freestanding tube portion at a resonant frequency thereof that varies with a combined density of the freestanding tube portion and contents of

the internal passage; and

means for sensing movement of the freestanding tube portion and producing an output signal based on the resonant frequency of the freestanding tube portion, the output signal being indicative of accumulation of the matter and thereby presence of the agent in the atmosphere surrounding the person.

[c9] 9. The device according to claim 1, further comprising means for measuring density of the at least one antidote.

[c10] 10. The device according to claim 1, further comprising means for sending a signal indicating the location of the person.

[c11] 11. The device according to claim 1, further comprising means for broadcasting an alert signal to a remote location if delivery of the at least one antidote is commenced.

[c12] 12. The device according to claim 1, further comprising means for monitoring biological functions of the person, identifying biological information based on the biological functions, and sending the biological information to a remote location.

[c13] 13. A device capable of detecting a chemical or biological agent, the device comprising:

a freestanding tube portion comprising an internal passage containing a substance selective to a chemical or biological agent so that matter accumulates within the freestanding tube portion;
means for flowing a fluidic sample through the freestanding tube portion;
means for vibrating the freestanding tube portion at a resonant frequency thereof that varies with a combined density of the freestanding tube portion and contents of the internal passage;
means for sensing movement of the freestanding tube portion and producing an output signal based on the resonant frequency of the freestanding tube portion, the output signal being indicative of accumulation of the matter; and
means for identifying the agent in the fluidic sample based on the accumulation of the matter in the freestanding tube portion.

[c14] 14. The device according to claim 13, wherein the freestanding tube portion is a constituent of a unit sufficiently small and light-weight to be carried by a person.

[c15] 15. The device according to claim 14, wherein the unit comprises at least one antidote, means coupled to the at least one antidote for selecting the at least one antidote based on the agent identified by the identifying means,

and means for delivering the at least one antidote into the body of the person.

[c16] 16. The device according to claim 15, wherein the delivering means comprises:

a second freestanding tube portion through which the at least one antidote flows;

means for vibrating the second freestanding tube portion at a resonant frequency thereof that varies with the density of the fluid flowing therethrough, the Coriolis effect causing the second freestanding tube portion to twist while being vibrated at resonance, the second freestanding tube portion exhibiting a degree of twist that varies with the mass flow rate of the fluid flowing therethrough;

means for sensing movement of the second freestanding tube portion and producing a first output signal based on the resonant frequency of second the freestanding tube portion and a second output signal based on the degree of twist of the second freestanding tube portion;

means for measuring elapsed time during which the fluid has flowed through the second freestanding tube portion; and

means for stopping flow of the fluid through the second freestanding tube portion in response to a specified amount of the at least one antidote having passed

through the second freestanding tube portion based on the elapsed time and the second output signal.

[c17] 17. The device according to claim 15, wherein the unit comprises a plurality of antidotes and the selecting means selects among the plurality of antidotes.

[c18] 18. The device according to claim 17, wherein the selecting means is operable to select more than one antidote, and the delivering means is operable to deliver the more than one antidote into the body of the person.

[c19] 19. The device according to claim 15, wherein the delivering means operates to deliver the at least one antidote subdermally, intravenously, intra-arterially, subcutaneously, intramuscularly, intraperitoneally or intrathecally.

[c20] 20. The device according to claim 13, wherein the fluidic sample flowed by the flowing means through the freestanding tube portion is air, water, blood or urine.

[c21] 21. The device according to claim 13, wherein the freestanding tube portion, the vibrating means and the sensing means are contained within an evacuated, hermetically-sealed enclosure.

[c22] 22. The device according to claim 13, wherein the free-

standing tube portion is a micromachine.

[c23] 23. A device for containing and delivering a plurality of antidotes, the device comprising a plurality of reservoirs containing the antidotes, a manifold to which the reservoirs are fluidically and removably coupled, an outlet on the manifold, and means for selectively releasing the antidotes from the reservoirs into the manifold and to the outlet.

[c24] 24. The device according to claim 23, wherein the releasing means is operable to simultaneously release more than one antidote.

[c25] 25. The device according to claim 23, further comprising means for delivering the antidotes from the outlet of the manifold and into the body of a person.

[c26] 26. The device according to claim 23, further comprising means for sensing flow of each of the antidotes from the reservoirs and means for stopping flow of the antidotes from the reservoirs in response to specified amounts of the antidotes having passed through the flow sensing means.

[c27] 27. The device according to claim 23, further comprising means for detecting the presence of a biochem agent and a power bus electrically connecting the releasing

means to the detecting means.

[c28] 28. The device according to claim 27, wherein the detecting means is operable to identify which of the antidotes is capable of counteracting the biochem agent.

[c29] 29. A method of detecting a chemical or biological agent, the method comprising the steps of:
flowing a fluidic sample through an internal passage within a freestanding tube portion, the passage containing a substance selective to a chemical or biological agent so that matter accumulates within the freestanding tube portion;
vibrating the freestanding tube portion at a resonant frequency thereof that varies with a combined density of the freestanding tube portion and contents of the internal passage;
sensing movement of the freestanding tube portion and producing an output signal based on the resonant frequency of the freestanding tube portion, the output signal being indicative of accumulation of the matter; and
identifying the agent in the fluidic sample based on the accumulation of the matter in the freestanding tube portion.

[c30] 30. The method according to claim 29, wherein the freestanding tube portion is a constituent of a unit carried by

a person.

[c31] 31. The method according to claim 30, wherein the unit comprises at least one antidote, means coupled to the at least one antidote for selecting the at least one antidote, and means for delivering the at least one antidote into the body of the person, and wherein the method further comprises the steps of:
sending a signal to the selecting means based on the agent identified in the fluidic sample;
selecting with the selecting means the at least one antidote as being capable of counteracting the agent; and then
delivering with the delivering means the at least one antidote into the body of the person.

[c32] 32. The method according to claim 31, wherein the step of delivering the at least one antidote comprises the steps of:
flowing the at least one antidote through a second freestanding tube portion;
vibrating the second freestanding tube portion at a resonant frequency thereof that varies with the density of the fluid flowing therethrough, the Coriolis effect causing the second freestanding tube portion to twist while being vibrated at resonance, the second freestanding tube portion exhibiting a degree of twist that varies with the

mass flow rate of the fluid flowing therethrough;
sensing movement of the second freestanding tube portion and producing a first output signal based on the resonant frequency of second the freestanding tube portion and a second output signal based on the degree of twist of the second freestanding tube portion;
measuring elapsed time during which the fluid has flowed through the second freestanding tube portion; and
stopping flow of the fluid through the second freestanding tube portion in response to a specified amount of the at least one antidote having passed through the second freestanding tube portion based on the elapsed time and the second output signal.

[c33] 33. The method according to claim 31, wherein the unit comprises a plurality of antidotes and the selecting means selects among the plurality of antidotes.

[c34] 34. The method according to claim 33, wherein the selecting step comprises selecting more than one antidote, and the delivering step comprises delivering the more than one antidote into the body of the person.

[c35] 35. The method according to claim 31, wherein the at least one antidote is delivered subdermally, intravenously, intra-arterially, subcutaneously, intramuscu-

larly, intraperitoneally or intrathecally.

[c36] 36. The method according to claim 29, wherein the fluidic sample is air, water, blood or urine.

[c37] 37. The method according to claim 29, wherein the freestanding tube portion is contained within an evacuated, hermetically-sealed enclosure, and the vibrating and sensing steps are performed by vibrating and sensing means contained within the enclosure.

[c38] 38. The method according to claim 29, further comprising the step of fabricating the freestanding tube portion using a micromachining process.

[c39] 39. A method of detecting a chemical or biological agent and treating a person exposed to the agent, the method comprising the steps of:
equipping the person with a unit sufficiently small and light-weight to be carried by the person, the unit comprising at least one antidote, means coupled to the at least one antidote for selecting the at least one antidote, and means for delivering the at least one antidote into the body of the person;
detecting and identifying a chemical or biological agent;
sending a first signal to the selecting means based on the identity of the detected and identified agent;

selecting with the selecting means the at least one antidote as being capable of counteracting the agent in accordance with the first signal;
sending a second signal to the delivering means; and then
delivering with the delivering means the at least one antidote into the body of the person in response to the second signal.

[c40] 40. The method according to claim 39, wherein the step of delivering the at least one antidote comprises the steps of:
flowing the at least one antidote through a freestanding tube portion;
vibrating the freestanding tube portion at a resonant frequency thereof that varies with the density of the fluid flowing therethrough, the Coriolis effect causing the freestanding tube portion to twist while being vibrated at resonance, the freestanding tube portion exhibiting a degree of twist that varies with the mass flow rate of the fluid flowing therethrough;
sensing movement of the freestanding tube portion and producing a first output signal based on the resonant frequency of the freestanding tube portion and a second output signal based on the degree of twist of the freestanding tube portion;

measuring elapsed time during which the fluid has flowed through the freestanding tube portion; and stopping flow of the fluid through the freestanding tube portion in response to a specified amount of the at least one antidote having passed through the freestanding tube portion based on the elapsed time and the second output signal.

[c41] 41. The method according to claim 39, wherein the at least one antidote is delivered subdermally, intravenously, subcutaneously, or intramuscularly.

[c42] 42. The method according to claim 39, wherein the unit comprises a plurality of antidotes and the selecting means selects among the plurality of antidotes.

[c43] 43. The method according to claim 39, wherein the selecting step comprises selecting more than one antidote, and the delivering step comprises delivering the more than one antidote into the body of the person.

[c44] 44. The method according to claim 39, wherein the step of detecting and identifying the agent is not performed on the person or with the unit.

[c45] 45. The method according to claim 39, wherein the step of detecting and identifying the agent is performed on the person and with the unit.

[c46] 46. The method according to claim 45, wherein the step of detecting and identifying the agent comprises the steps of:

flowing a portion of atmosphere surrounding the person through an internal passage of a freestanding tube portion, the passage containing a substance selective to the agent so that matter accumulates within the freestanding tube portion;

vibrating the freestanding tube portion at a resonant frequency thereof that varies with a combined density of the freestanding tube portion and contents of the internal passage; and then

sensing movement of the freestanding tube portion and producing an output signal based on the resonant frequency of the freestanding tube portion, the output signal being indicative of accumulation of the matter and thereby presence of the agent in the atmosphere surrounding the person.

[c47] 47. The method according to claim 39, further comprising inserting the delivery means into the body of the person after the step of detecting and identifying the agent.

[c48] 48. The method according to claim 47, wherein the step of sending the second signal to the delivering means is

manually performed by the person.

[c49] 49. The method according to claim 47, wherein the step of detecting and identifying the agent is not performed on the person or with the unit.

[c50] 50. The method according to claim 39, wherein the step of detecting and identifying the agent occurs after inserting the delivering means into the body of the person.

[c51] 51. The method according to claim 50, wherein the step of detecting and identifying the agent is performed on the person and with the unit.

[c52] 52. The method according to claim 50, wherein the step of detecting and identifying the agent is not performed on the person or with the unit.

[c53] 53. The method according to claim 50, wherein the steps of sending the second signal to the delivering means and delivering the at least one antidote into the body of the person are performed without intervention by the person or others.

[c54] 54. The method according to claim 50, wherein the step of sending the second signal to the delivering means is manually performed by the person.

[c55] 55. The method according to claim 39, further compris-

ing measuring the density of the at least one antidote during the delivering step.

[c56] 56. The method according to claim 39, further comprising sending a signal indicating the location of the person.

[c57] 57. The method according to claim 39, further broadcasting an alert signal to a remote location if delivery of the at least one antidote is commenced.

[c58] 58. The method according to claim 39, further comprising monitoring biological functions of the person, identifying biological information based on the biological functions, and sending the biological information to a remote location.